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THE CHICAGO MEETING

THE seventy-third meeting of the American Association for the Advancement of Science, held in Chicago from December 27 to January 1, was the second of the greater convocation week meetings of the association and of the national scientific societies associated with it, convened once in four years successively in New York, Chicago and Washington. The remarkable scientific activity of the central west and of the reconstruction period following the war were adequately reflected by the attendance and programs at Chicago, which have probably not been surpassed by any previous gathering of scientific men in this or any other country. In addition to fourteen sections of the association, forty-one national scientific societies met in Chicago and the official program of 112 pages exhibited the scientific productivity of the nation in the whole range of the natural and exact sciences.

The association has been fortunate in its presidents. The address of the retiring president, Dr. Simon Flexner, director of the laboratories of the Rockefeller Institute for Medical Research, on "Twenty-five years of bacteriology," printed in the last issue of SCIENCE, was an admirably clear presentation of a subject unsurpassed in its importance to human welfare, described by one who has led in the work. Dr. L. O. Howard, chief of the Bureau of Entomology, presided with dignity, skill and tact. He has played a large part in a subject in which science has demonstrated its service in the economic development of the nation and has been the chief executive officer of the association during the twenty-two years which have witnessed such an extraordinary development of the scientific work of the country, paralleled by the growth of the association from some 1,200 to over 10,000 members.

Professor E. H. Moore, of the University of Chicago, who will preside at Toronto and give his address at Boston is the acknowledged leader of American mathematicians. It is now many years since that science which is fundamental to all others has supplied a president to the association, and it is fortunate that a representative could be selected with the unanimous approval of all mathematicians.

Dr. D. T. MacDougal, director of the department of Botanical Research of the Carnegie Institution, who has been active in the organization of the work of the association, more specially in the Pacific and Southwestern Division, was elected general secretary to succeed Professor E. L. Nichols, of Cornell University. By the constitution the general secretary is entrusted with the important task of promoting the organization of the association especially in its relation to the affiliated societies. Another step that will promote the efficiency of the work of the association was the authorization of the appointment of an assistant secretary who will assist the permanent secretary in the scientific work of the association, as he is now assisted in the work of the office by the efficient executive assistant, Mr. Sam Woodley.

The sessions were held mainly in buildings of the University of Chicago, which furnished excellent facilities. The University Baptist Church provided for the sessions of Section K, Political and Economic Sciences, and the Quadrangle Club (Faculty Club) was also made available for some meetings, dinners, etc. At the Chicago Art Institute was held the reception of the Wild Flower Preservation Society, at which was exhibited a collection of flower portraits, etc. The exhibit of working models on wireless telephony, set up through the cooperation of the National Research Council, was also in the Art Institute.

The local arrangements for the meeting were in charge of the local committee:

J. Paul Goode, General Chairman
Gilbert A. Bliss, Publicity
Henry C. Cowles, Membership
Henry G. Gale, Meeting places
Frank R. Lillie, Finance
William D. McMillan, Hotel Accommodations

To the efficient and tireless efforts of Professor Goode and the other members of the local committee is due, in very great measure, the success of the Chicago meeting.

The arrangement by which admission to the three general sessions was by ticket perhaps caused a small amount of unavoidable difficulty, but it made possible an analysis of the attendance. This rule is in exact accord with the provisions of the by-laws. Tickets were given out only to registered persons, this applying to guests as well as to members.

The total registration for the Chicago meeting was 2,412. This is the largest registration ever recorded for the association, but it must be remembered that many persons in attendance at the meeting failed to register, so that the corrected number was much larger. Of those registering 1,383 were members of the association or delegates from institutions, 377 were members of associated societies not members of the association, 237 were invited guests, students of the University of Chicago, and 415 were other guests.

The geographical distribution of the attendance is shown below:

United States	Total	United States	Total
Alabama	4	North Carolina	7
Arkansas	5	Oregon	3
Arizona	7	Oklahoma	15
California	27	Ohio	121
Colorado	22	Pennsylvania	57
Connecticut	21	Rhode Island	5
Delaware	1	South Dakota	8
Dist. of Columbia.	81	South Carolina	3
Florida	4	Tennessee	19
Georgia	6	Texas	16
Idaho	1	Utah	1
Illinois	856	Virginia	8
Indiana	98	West Virginia	11
Iowa	90	Vermont	2
Kansas	63	Wyoming	4
Kentucky	17	Washington	5
Louisiana	5	Wisconsin	181
Maine	0	Other Countries	Total
Massachusetts	50	Philippines	10
Maryland	15	Australia	1
Missouri	70	Argentina	1

Mississippi	10	Porto Rico	1
Michigan	125	India	1
Minnesota	72	Switzerland	1
Montana	5	France	1
Nebraska	29	Japan	1
New Hampshire..	9	China	20
New Jersey	16	Germany	1
New Mexico	2	Canada	48
Nevada	0	England	2
New York	132	Czecho-Slovakia ..	1
North Dakota ...	12	Grand Total ...	2,412

Two general evening sessions of popular interest, were held. At one of these was given an illustrated lecture by Dr. R. F. Griggs, on the region of Mt. Katmai, Alaska, and the "Valley of Ten Thousand Smokes." The other general interest lecture was by Professor R. W. Wood, on high power fluorescence and phosphorescence, in connection with which he performed numerous very ingenious experiments and demonstrations dealing with the study of these phenomena and of ultra-violet light.

The opening session, Monday evening, and the two general interest sessions were held in Mandel Hall. Attendance on these three evenings was as follows:

	Members of A. A. A. S. and Delegates	Guests, Members of Associated Societies Not Members of A. A. A. S.	Guests, University Students	Special Guests Not in Other Groups	Total Attendance
Opening session, Monday evening, opening addresses and address of retiring president, Dr. Simon Flexner	401	94	76	142	713
Second general session, Lecture by Dr. Robert F. Griggs.....	279	78	86	76	519
Third general session, Lecture by Dr. Robert W. Wood.....	380	101	76	153	710

Several new or unusual features characterized this meeting. The visible directory of those registering, kept currently corrected by several typists and attendants, proved very valuable. The panels bearing the directory slips were hung along one side of the registration room, the north room on the first floor of Reynolds Club.

The increase of scientific knowledge and interest among the general public is one of the most important functions of the association and the one which it has been most difficult to accomplish. The reports in the press vary from year to year, and at Chicago represented a fair average. Several of the more important papers, such as that of Professor Michelson on the application of interference methods to astronomical measurements, were fully report, not only in Chicago but also in New York and other cities. The Science Service definitely organized at Chicago for the wide-spread diffusion of current scientific information will hereafter make possible adequate reports of scientific meetings.

The minutes of the proceedings of the Council, and reports of sections and affiliated societies will be printed in later issues of SCIENCE. Among the matters of general interest transacted at the meetings of the Council are the following:

It was decided that the next meeting of the American Association will be at Toronto, on Tuesday, December 27 to Saturday, December 31, 1921, inclusive. The opening session will be on Tuesday evening. The meeting for 1922–1923 will be held in Boston, and that for 1923–24 will be held in Cincinnati. Then will follow the stated convocation meeting in Washington.

Dr. Burton E. Livingston was reelected permanent secretary and Dr. R. S. Woodward was reelected treasurer, each for a term of four years. Dr. L. O. Howard and Professor Herbert Osborn were elected members of the executive committee.

The Academies of Science of Michigan and of Oklahoma were affiliated with the association.

The collection of portraits and autograph letters of all presidents of the association made by Dr. Marcus Benjamin of the Smithsonian Institution will be purchased under conditions representing a partial gift to the association.

The sum of $5,000 was appropriated for

the Grants Committee to distribute during the year 1921.

On the Jane M. Smith fund the following were appointed with power to act during 1921: L. O. Howard, W. J. Humphreys and B. E. Livingston.

Among the resolutions adopted by the Council are the following:

Be it resolved: That the American Association for the Advancement of Science would welcome the organization of Mexican men of science, and their affiliation with this Association.

Resolved: That a committee of seven be appointed to cooperate with such organization as Mexican men of science may form.

The following were appointed on this committee: L. O. Howard, *Chairman,* A. E. Douglas, E. L. Hewitt, D. S. Hill, W. J. Humphreys, D. T. MacDougal and W. Lindgren.

Whereas the American Association for the Advancement of Science includes sections on Physiology, Experimental Medicine and Zoology, and

Whereas advancement of knowledge in these sciences, which is dependent upon intensive study of living tissue, is inevitably followed not only by amelioration of human suffering, but also by a lessening of animal disease and by substantial economic gain and by conservation of the food supply, and

Whereas this association is convinced that the rights of animals are adequately safeguarded by existing laws, by the general character of the institutions which authorize animal experimentation and by the general character of the individuals engaged therein,

Therefore be it resolved, that this association agrees fully with the fundamental aim of those whose efforts are devoted to the safeguarding of the rights of animals but deprecates unwise attempts to limit or prevent the conduct of animal experimentation such as have recently been defeated in California and Oregon, for the reason that such efforts retard advance in methods of prevention, control and treatment of disease and injury of both man and animals and threaten serious economic loss, and be it further

Resolved, that a copy of these resolutions be included in the official records of this Association, and that copies be sent to the national congress, to the legislatures of each state in the union and to each member of the Association.

Whereas, clean culture of roadsides and the drainage of marshes in the United States is imperiling the existence of the wild-life of our country not now included in special preserves, and

Whereas, the preservation of this wild-life not in preserves is felt to be of great national importance not only to students and lovers of nature, but to human welfare in general, therefore,

Be it resolved, by the council of the American Association for the Advancement of Science, that it appreciates the importance of preserving this wild-life not in preserves, and that it lends its moral support to the effort to combine all interested organizations in a cooperative investigation and conservation program for the preservation of our unprotected wild-life.

Whereas, in recognition of the unique character and value of our National Parks and Monuments to present and future generations, twenty-four successive Congresses have wisely resisted attempts to commercialize them and have preserved them inviolate for nearly half a century,

Whereas, certain private interests are now seeking to secure special privileges in these areas, which if granted will seriously interfere with their true purpose and undoubtedly result in the entire commercialization of these unique national museums,

Therefore, be it resolved, that the American Association for the Advancement of Science request members of Congress first to amend the Water Power Act so that it shall not apply to National Parks and Monuments and that their full control be restored to Congress, and second, to reject all present and future measures which propose to surrender any part of these National Parks and Monuments to private control or to divert them in any way from their original and exclusive purpose, the preservation for all future generations of unique representations of natural conditions such as exist in no other part of the world.

SOME ECONOMIC PHASES OF BOTANY[1]

It is an old custom for the retiring vice-president of this section to deliver an address.

[1] Address of the vice-president and chairman of Section G, botany, American Association for the Advancement of Science, Chicago, 1920.

These addresses have taken various forms; in some cases a review of the achievements in some particular phase of botany; others have looked to the future. It has been my pleasure to have heard many of the addresses on these annual occasions for thirty years, and I feel sure that they have epitomized the botany for the time. As I look back I find there was much of inspiration in these addresses. We regret that some of the men who sounded the keynote at these gatherings are no longer with us. It is interesting to look back to see what was uppermost in the minds of the speakers on these different occasions: N. L. Britton, "Botanical Gardens"; J. C. Arthur, "Development of Vegetable Physiology"; L. M. Underwood, "The Evolution of the Hepaticæ"; T. H. Macbride, "The Alamagordo Desert"; D. H. Campbell, "The Origin of Terrestrial Plants"; H. C. Cowles, "Economic Trend of Botany"; B. T. Galloway, "Applied Botany Retrospective and Prospective"; William Trelease, "Some Twentieth Century Problems"; Charles R. Barnes, "The Progress and Problems of Plant Physiology"; W. G. Farlow, "The Conception of Species as Affected by Recent Investigations on Fungi"; Geo. F. Atkinson, "Experimental Morphology"; R. A. Harper, "Some Current Conceptions of the Germ Plasm"; F. C. Newcomb, "The Scope and Method of State Natural History Surveys"; Duncan S. Johnson, "The Evolution of a Botanical Problem"; Geo. P. Clinton, "Botany in Relation to American Agriculture"; H. M. Richards, "On the Nature of Response to Chemical Stimulation"; C. E. Bessey, "The Phyletic Idea in Taxonomy"; D. T. MacDougal, "Heredity and Environic Forces"; B. L. Robinson, "The Generic Concept in the Classification of Flowering Plants"; A. F. Blakeslee, "Sexuality in Mucors." Dr. Coulter in his address as president of the association spoke on "Botany as a Nationai Asset."

In reading these addresses one certainly feels that a wide range of thought and investigation is covered. When I began to reflect on a topic suitable for an occasion of this kind, and suitable for one who has been engaged in trying to interest students and help to solve some of the problems confronting those who have to deal with the economic phases of our subject, it occurred to me that "some phases of economic botany" would give me a chance to offer some suggestions that might be a stimulus to bring together the varying interests of botany.

HUMAN INTEREST OF BOTANY

Botany should, first of all, have an intensely human interest from the standpoint of our well being. If we recognize this fact then plants should be studied not only for what use they may be to man directly and indirectly, but we must recognize also the cultural value of botany in schools, colleges and universities. Those who have had something to do with the park movement in the United States appreciate, of course, that the general interest in plants is really greater now than ever before. The layman to-day takes intense delight in the great out of doors and he does so for the pleasure he gets out of contact with nature. To such men and women a knowledge of plants becomes an intensely fascinating subject. They are becoming as truly cultured as the men or women who studied Shakespeare or any other of the great writers. This is a new culture which I think means much to the human race and our profession. It develops the highest instincts and elicits highest emotions. Let us not forget that the much despised taxonomic botany has a real place in our life, especially for those who have come to look upon the out of doors as a means to enjoy life.

EARLY ECONOMIC BOTANISTS

Let us take a little retrospective view of the subject. Botany began as an economic subject. Dioscorides, Pliny, Aristotle and Theophrastus were observers who gave to the world what they observed in the plant kingdom, largely on economic plants. Moreover they related in good form what previous writers had observed, with comments on culti-

vation. Theophrastus and Pliny both made some ecological observations which were destined to play an important part in investigations of the future.

WHAT THESE MEN OBSERVED

Let us frankly recognize the service these men rendered to increase our knowledge of plants. The plant pathology of these earlier writers was primitive of course and the plant pathologist of to-day would hardly class this early work under that term. This knowledge of the ancients was buried for centuries, in which little attention was given to botany or related subjects, but we may feel sure that during the "Dark Ages" man was intensely interested in the economic phases of botany although we have little written evidence of such interest. Botanists of long ago paid some attention to medical botany. We need only recall that such treatises as Gerard's "Herbal" and later the painstaking work of Hayne, "Die Arzneigewäshse," Rafinesque, "Medical Flora," and many others of the old writers up to the modern work of Millspaugh, "American Medical Plants," Kraemer, "Pharmacognosy," and Luerssen, "Handbuch der Systematischen Botanik," have kept us up with the times.

We know that the Crusaders brought from Asia and eastern Europe medicinal plants, cereals and fruits that made possible the highest type of civilization, for improved plants accompanied a revival of learning. We may be sure that during this epoch the economic phases of plants were studied because of the importance of increasing the food supply. The knowledge gleaned was passed on to the next generation to be of some use to man, and followed by the work of others who for the most part were observers, and our science, it must be said, began in observation. Men like Robert Morison, a close student of Cesalpino, Kasper Bauhin and others, added a little to the knowledge of previous botanists. John Ray and Francis Willoughby became interested in another phase of economic botany; they conducted experiments on the motion of sap in trees. Ray was generous to his predecessors like Grew, Jung and Malpighi. The old myth that wheat will degenerate in chess probably started with Ray, because he published a statement that *Triticum* could be changed into *Lolium*. Malpighi, the father of microscopical anatomy, gave a fair account of the structure of plants, including the ducts and the Malpighian cell. Economic plants always received special attention.

The English philosopher, Robert Hook, gave a fair account of cork, which he had studied with his improved compound microscope. He investigated the nature of food of plants.

Grew, in his "Anatomy of Plants," outlines in a masterly way the architecture of plants, interwoven however with the philosophical and theological prejudices of the time.

Bachman, who was a botanist, physiologist, pharmacologist and chemist, appreciated morphology and taxonomy. He introduced binomial nomenclature, and the reason given by him was that a prescription could be written easier. Think of it, that we as botanists are indebted to medicine for the naming of plants. Bachman refused to recognize cultivated varieties as species. Tournefort had only to go a step to recognize genera which he did in a splendid way. The last link in the chain of the botanists who were influenced by the older school was Linnæus, who borrowed from his predecessors like Cesalpino, Jung, Bachman and others, but always with fulsome praise of the work of his contemporaries and predecessors.

Sachs says:

> We are astonished to see the long known thoughts of these writers (Bauhin, Cesalpino, Jung), which in their own place look important and incomplete, fashioned by Linnæus into a living whole; thus he is at once and in the best sense receptive and productive.

Linnæus thought it important to know all species of plants. His "Philosophica Botanica" was a splendid text-book of botany. There was nothing else like it for more than a generation, at least there was nothing that equalled it in clearness and completeness. He

was not an experimenter and cared little for it. In Germany, under his influence taxonomy degenerated into mere plant collections, collectors calling themselves taxonomists.

POST-LINNÆAN BOTANY

A new era opened with such men as Jussieu, Gaertner, DeCandolle, Robert Brown, Adanson, Endlicher who knew how to observe and interpret the things they saw. Experimental work with plants became more important; botanists began to ask the why about plants; and so E. Mariette, one of the first experimental physicists, studied the salts of plants and the active forces of attraction and nutrition.

Martin Lister directed attention to the movement of water in plants. Christian Wolff, too, experimented on the nutrition of plants. Stephen Hales in his "Statistical Essays" sought to trace back the phenomena of vegetation to mechanico-physical laws, as then understood, and studied the water taken in by plants and its exit by the leaves and the formation of solid substances.

The discovery of oxygen by Priestley was important in plant physiology, but he missed the important discovery that light is a vital factor in making plant food. This was left to Jean Ingenhousz, whose experiments showed that purifying of air goes on in light only. This led him to study the food of plants and the improvement of soils. He discovered that plants use CO_2 and under the influence of light make plant food. Jean Senebier was the first to give a clear statement of the process of photosynthesis. We are indebted to the chemist, DeSaussure, for his discoveries, which laid the foundation in an experimental way of the process of food-making in plants. It is a long way from the researches of these pioneers to the work of Boussingault's quantitative methods of studying the food requirements of plants, especially with reference to nitrogen, and the work of Sprengel on ash constituents and Liebig's work, "Chemistry in its Relation to Agriculture and Physiology." These greatly helped to advance plant physiology, as did also the work of Lawes and Gilbert on the mineral constituents of plants and later the pot culture method of Knop, Sachs, and the work of Lachmann, who in 1858, spoke of the "Vibrionenartige" organisms found in leguminous nodules. Later the work of Schloesing and Muntz, Warrington, Beijerinck, Winogradsky, Hellriegel and Wilfarth and many others made secure for ever a better agricultural practise. Added to the knowledge of the importance of the legume bacteria the important discoveries of Wollny and Berthelot show that bacteria in the soil are the makers of plant food.

Plant physiological work in Europe made rapid strides through the labors of Detmer, Pfeffer, Sachs, Jost, Palladin, Haberlandt and many others. The question of photosynthesis long remained obscure because of insufficient chemical study of the plant pigments. The environmental factors were partially determined by F. B. Blackman and then Willstatter and his coworkers determined the chemistry of chlorophyll, which enabled plant physiologists to better understand the problems of carbon assimilation. Jorgensen and Walter Stiles in their résumé say:

> No prophetic vision is needed to foretell development in plant physiology as great as those which were produced by physics and chemistry in engineering and other technical sciences.

It is refreshing to observe that a soil physicist like Edward Russell in his paper "Soil Conditions and Plant Growth," should put stress on plant physiological problems as fundamental to a study of soils and plant nutrition.

Jung did not entertain any definite idea of the sexuality of plants nor did Grew have a clear conception. Rudolph Camerarius, however, settled the problem by making experiments with maize and mulberry, two economic plants.

We can only marvel at the economic trend of the work of Leewenhoek in the study of linen, who made the discovery of minute organisms, and thus repudiated the theory of abiogenesis. People became curious to study the hitherto unseen world. The use of the microscope in the hands of the curious was

not for scientific or practical purposes, but gave source to wild speculations in disease and the origin of life. However, its useful day came many years later, when its discoveries were made use of in many practical problems, connected with disease of plants and animals and the physiological problems in connection with crop production.

PLANT PATHOLOGY

Meyer, an extraordinary man who died at the age of thirty-six, published a work on phytopathology, a paper on corn smut and one on actinomyces. He was a physiologist and looked at the problem of disease from the standpoint of physiology, really the only way the subject should be treated. Camerarius seems to have antedated the work of Meyer by over one hundred years in the publication of his paper "De Ustilagine Frumenti." Julius Kuehn was primarily an agriculturist and as director of the Agricultural Institute at Halle started a series of experiments on plants that have become classic. While thus engaged in the work he became interested in a study of the diseases of plants. To him we owe the first comprehensive treatise on plant pathology. He had breadth of vision to study and interpret what he saw with the microscope and thus there came into being "Die Krankheiten der Kulturgewächse," which stands as a monument to his labors. It is the only botanical paper by him listed by Pritzel in his Thesaurus. M. J. Berkley's work, "Introduction to Cryptogamic Botany," gave to English-speaking people the first real treatise on plant diseases, which laid a sure foundation for a study of plants, along economic lines.

All of the work on plant diseases and the anatomy of plants was better established later through the classic work of DeBary. DeBary, of course, did not have, except in some cases, the practical problems in mind, though the science of botany and plant pathology in particular have been greatly benefited through his profound researches in connection with the development of life history of fungi. DeBary brought to the science of mycology a breadth of knowledge along many lines of botany and one marvels at the enormous amount of research work he did. Nor should we omit to mention the great work of Tulasne (who had the merit of first breaking the ground in a study of rust, smuts and ergot), on the discovery of the germination of the spores of rusts, smuts and the sexual organs of Peronospora. While these researches did much for mycology, indirectly they have been of great practical importance to pathology. Robert Hartig, perhaps the foremost student in the world during his lifetime of the diseases of forest trees and the decomposition of wood, exerted a great influence on the practise of forestry, followed later by the splendid work of Marshall Ward, a student of Hartig. We may mention in this connection the work of Fischer de Waldheim, Wolff, Sorauer, Appel, Millardet, Prillieux, Jones, Halsted, Arthur, Bolley, Atkinson, Stewart, Whetzel, Freeman, Clinton, Thaxter, Duggar, Stakman, Cook, Stevens and Melhus. These as well as a host of others, added to this economic phase of botany, making secure the science of plant pathology. I need only add here that the stimulus given by these men to this economic phase of botany has been communicated to all parts of the world; and so we may mention especially the pioneer work by Dr. Farlow on Gymnosporangium, grape vine mildew, onion smut, Dr. Burrill on apple blight and sorghum blight, the epoch-making researches along the line of bacterial diseases of plants by Dr. Erwin F. Smith. Surely America may well be proud of its achievements. The present age has hundreds of new problems in plant pathology. The superficial only was touched on by the early workers. We may mention especially the root disease of cereals and other crops. The plant pathological studies on these parasites has changed our methods of agriculture completely. We need more careful and profound work on many of the problems worked upon by the pioneers. The pioneers who blazed the way may be excused for errors, but the modern investigator should not be. He has the

equipment and money and should do good work.

POLLINATION OF FLOWERS

Another phase of the subject of economic botany is that of pollination. Progress was slow. Geoffroy, who as early as 1711 made some observations on the nature of the style, is said to have conducted some experiments with maize; however that may be he did make use of the work of Camerarius. Geoffroy concluded from various sources that fertilization was a kind of fermentation, but he was inclined to accept a second view of Morland that the pollen grains contain the embryo which find their way to the seed. We may also recall the work of John Logan, at one time governor of the colony of Pennsylvania, who conducted experiments on the fertilization of maize, in which he noted that cobs covered with muslin did not produce seed, but seed was formed on cobs where pollen came in contact with the stigmas. Logan suggested that the wind carried the pollen. Gleditsch in a study of one of the palms (*Chamærops humulis*) strewed loose dried pollen on the stigmas of a female plant which produced seed which later was planted and germinated; a simple experiment but a convincing one to the botanists of the time, who had never seen pollination demonstrated before. Philip Miller in 1751 calls attention for the first time to the importance of insects in the pollination of tulips. The first scientific experiments on hybrids were made by Koelreuter, who discovered the use of nectar and the importance of insects in the pollination of flowers. Koelreuter clearly set forth the facts that the mingling of two substances produced a seed. These general statements as set forth by him still hold true. He was a skillful experimenter in the hybridizing of plants. The work of Sprengel on the pollination of flowers is well known to the older botanists. His sharp discriminating observations on the relation of insects to flowers were little understood at the time. The full import of these problems were recognized by Charles Darwin, who in his masterly way showed the application of this in practical problems. Earlier Sir Andrew Knight had demonstrated "that no plant fertilizes itself through an unlimited number of generations." Dr. Gray put this in a much more terse way. A score of investigators like Hermann Mueller, Fritz Mueller, Delpino, Ludwig Axell, Hilderbrandt and in our country men like Gray, Trelease, Riley, Foerste, Beal and Robertson demonstrated the use of insects in pollination and the application of this fact to important agricultural crops. These fundamental facts are fully recognized to-day in the growing of apples, alfalfa, sweet clover, melons, squash and cucumbers. The orchardist recognizes the importance of bees in connection with the growing of apples, pears and plums. The farmer recognizes the importance of bees in the alfalfa and sweet clover fields, just as Charles Darwin recognizes that the bumble bee is important in the red clover pollination. In this connection, as an economic problem, I may call attention to the honey flow in flowers. It is true beekeeping is only one of our minor agricultural problems dependent entirely on the relative abundance of honey plants in a given region. There are a great many interesting physiological problems in connection with nectar secretion, as Kenoyer has shown. One wonders why alsike clover scarcely yields any nectar for bees in Iowa and yet in some regions of the country it is one of the best of nectar plants. There is seldom any nectar in buckwheat flowers after 10:00 A.M. in Iowa, and yet in sections of the United States the period of nectar flow is much longer. Is soil alone a factor or is moisture an important factor, or are the two factors combined? We have enormous expanses of waste land along our highways in the United States, why not combine the esthetic with the economic if we can find plants that are suited for such places that will yield good returns for the beekeeper.

PLANT BREEDING

I heard a practical fruit grower in Iowa say the other day when a new chance seedling apple was shown me that nearly all of the new good things in the fruit line are chances; that

is to say the new productions by Burbank, Hansen, Patten, Beach, Hedrick, Webber and many other plant breeders are not equal to those found in nature. I need only recall the many fine things the modern plant breeder has produced. Of course, new types will always appear, as they have in the past. The work accomplished, it seems to me, will justify larger expenditure of money.

In the matter of fundamental study of these problems practical agriculture, horticulture and floriculture are indebted to the classic fundamental work of Hoffmeister and Strasburger. This work led up to and explains the physical basis of Mendelism discovered by Gregor Mendel, a work that is most important in the breeding of new types. We have had a host of botanical investigators who have enhanced our knowledge of plant breeding, linking it with practical work like Nilsson, Johannsen, Bateson, Correns, Shull, White, Webber and Emerson. Agriculture and horticulture are indebted to the epoch-making work of DeVries on mutation. His work has set a score of botanists to work on the pedigree culture work. I may mention Nilsson, Johannsen and Gates especially. Possibly the outstanding problem of the pomologist in states like Iowa and Minnesota is that of hardiness. In breeding experiments at the present time it is necessary to set the trees out and test them for a term of years, to see whether or not this climate is too severe. Bakke in some recent experiments has found that by ascertaining the depression of the freezing and the moisture content at a time when all the tissues are in an active state of growth, it is possible to obtain an idea of the comparative hardiness of different apple trees. These tests have been made upon trees in the nursery as well as upon trees in an orchard, 10 years old, with practically the same results.

SEED STUDIES

After a consideration of pollination the matter of seed is of importance. The first great work published is that of Gartner, "De fructibus Seminibus plantarum." Gartner was free from the bias of those who preceded him. We have a truly modern work by one whom we may regard as a modern man of science. He made a comparative study, correctly determined the relation of the endosperm to the cotyledon and named the embryo. We have had a long line of investigators on the subject of seeds.

The practical application found expression in the work of Nobbe, Harz and others. We may recall the work of Nobbe in the testing of seeds at the small experiment station at Tharand, which was the beginning of the experiment stations such as we know them today. Nobbe did not merely do the mechanical part in connection with the testing of seed, but inquired into real scientific problems in connection with specific gravity, and the vitality of seeds under different conditions of storing. The germination of many seeds is of special concern to the agriculturist, because it is important to know under what conditions a seed will germinate best to bring the largest returns. It is a matter also of some concern for the farmer to know whether weeds' seeds have a varying period of vitality when buried in the soil, whether for instance the seeds of *Hibiscus Trionum* and *Abutilon Theophrasti* will come up in his fields after a quarter or half a century when he practises rotation of crops. The vitality and structure of seeds has of course received much attention. I need only recall the classic work of DeCandolle who more than a century ago studied the prolonged vitality of seeds. The data secured by DeCandolle is frequently quoted in text-books of plant physiology. Also much later work of Becquerel, Beal, Ewart and Hanlein on delayed germination, as well as the work of Crocker and his students like Shull, on the delayed germination of seeds, like wild oats and other seeds of economic importance. To Crocker we are indebted for an explanation of the delayed germination of such seeds as the cocklebur. Knowing that there is a delay in some seed the farmer is better able to follow a rational practise in the treatment of seeds. I am sure that most of you are familiar with the work of Schleiden and Vogel, Chalon, Malpighi,

Haberlandt, Sempolwski, Beck, Moeller and Oesterle, Mattirolo and Buscalioni, Hanausek, Harz, Junowicz and many others who were interested in a study of seeds of Leguminosæ, particularly with reference to the light line. The writer more than a quarter of a century ago brought the literature on this subject together in his paper on the "Comparative Anatomy of Seeds of Leguminosæ." Comparatively little has been done since. Intensive studies on the seeds of such families as the Leguminosæ. Convolvulaceæ, Cucurbitaceæ, Malvaceæ, Tiliaceæ should be made because in most of these families where the light line occurs the seeds have a prolonged vitality. The subject has more or less of a practical bearing. The problem as to the nature of the light line in these seeds has not been solved. A number of present-day botanists, like Martin, Harrington and others are taking up the problem. Present-day investigations with seeds are bringing many valuable practical results in commercial seed production, as in clovers. The seed control work by the establishing standards of purity is a practical problem. The work in determining the conditions of germination, experiments with light, electricity, heat, moisture and drying and studies of seed coat are also important. The important problem of rate of maturing of seed in storage is being worked out. Seed-testing laboratories, while they are obliged to answer the immediate pressing problems on the impurities of seeds and their germination are engaged in a study of the more fundamental problems of the viability of seeds. It has been the custom for the American Seed Analysts Association to send to its co-workers seeds to test for purity and vitality. With careful treatment, there is still the greatest variation in the results. Presumably, in part at least, the methods used by seed testers is not the same and, therefore, the result can not be uniform. We should bear in mind that the viability is a matter of climate and condition of storage of the seed. The fundamental problems of every one of the great staple agricultural crops, so far as vitality of seeds is concerned, has not been entirely solved and awaits solution by the investigator.

The writer and Miss King, during the past few years, have continued investigations on germination of seeds of forest trees and shrubs. The results exhibit surprising irregularity and uncertainty in the germination of these seeds. Boerker, of Nebraska, has followed the same line of research. The work of Sir John Lubbock on Seeds and Seedlings and various papers of Tubeuf on seeds of forest trees, although purely morphological are always valuable for reference and bear in general upon forestry problems, of economic botany.

GRASSES

Botanists have long recognized the importance of grasses in our welfare. The prosperity of the United States outside of the rich natural resources of forestry, mines and water power is concerned with the economic production of cereals, cotton and livestock. Turning to some of the older works I recall the work of Sowerby and Parnell on grasses, Metzgar, "Die Gereidarten," Stebler and Schroeter, "Körnicke, Die Gebreidearten," and Hackel, "True Grasses." In our own country early works were Flint's "Grasses of Massachusetts," Klippart, "Grasses of Tennessee," Lapham, "Grasses of Wisconsin," Vasey, "Grasses of the United States," Lamson-Scribner, various papers published by the U. S. Department of Agriculture, Beal, "Grasses of North America," Hitchcock and Chase papers. These and other authors touching the economic problems of cereals, like Hunt, Carleton, Shear, Warburton and Ball have stimulated prduction but it would seem as though we have only scratched the surface so far as a study of the real problem of cereal production is concerned. It vitally concerns us as a nation to stimulate the production of cereals and forage crops because the ever-increasing population demands increased production. How can the botanists contribute more to the welfare of mankind than to study such problems as the physiology of the nutrition of the growing of wheat, maize, oats, barley and rice, or to make a study of pollination

under different climatic conditions, or the breeding of varieties of cereals resistant to diseases? We might well consider the stupendous losses from parasitic fungi of cereals. There never was a time when research on cereals and other agricultural crops was as important as it is to-day. We have, on a large scale, undertaken the removal of the barberry in the wheat-growing section of the country, because the plant pathologists are convinced that the common barberry is an important factor in rust production. And yet, I was confronted with the frequent statement by practical men in western Minnesota that there is no barberry in this particular section. I certainly saw none in the immediate area to speak of, although there was some barberry thirty miles to the south. I could not make the questioner see the importance of the barberry in connection with grain rust. Some seasons no doubt there are actually viable uredo spores on grasses. The point, I think, we should determine to convince the wheat grower on is this: are the uredo spores viable in weedy grasses, and how far can the uredo spores be carried? The farmer who loses $3,000 on a quarter section of land in a single year of wheat-growing wants some solution of the problem. It is the duty of the government and the botanist to solve the problem for the country. Unless this is done by exterminating the barberry, the breeding of resistant varieties and the elimination of weedy grasses, the growing of spring hard wheats will be a thing of the past, and the farmer will be forced to turn his attention to the growing of other cereals, not subject to rust. The government and the states directly interested, can well afford to spend a half million dollars annually until the problem is solved.

WEEDS

The subject of weeds is related to that of plant disease. It greatly interests the farmer and gardener. The farmers of the United States, at least in some sections, have endeavored to remove by legislation some of the injurious weeds, expecting, of course, that the law would be obeyed and the weeds would soon be eliminated, but instead they are constantly increasing. As illustrations of weed legislation I need only remind you that some twenty-five years ago nearly all the northwestern states made it illegal to permit Russian thistle to grow. During these twenty-five years it has spread from the Atlantic to the Pacific. In Washington and Colorado where the conditions are suitable it covers the ground on little travelled roads and on the plains. In Iowa we made an effort by legislation to reduce the infested areas of quack grass, but it has so increased that the farm values in some cases are reduced because of its presence. During the past two seasons I have received a large number of specimens of knapweed (*Centaurea solstitialis*) from many points in Iowa and northern Missouri, distributed largely through alfalfa seed. Buckhorn (*Plantago lanceolata*) is rapidly interfering with clover culture in Iowa.

We have described weeds and how to eradicate them, because this is the kind of information the farmer wants, but we have not solved a single one of the important problems in connection with weeds. Weeds have an important bearing on the crops produced. The small ragweed no doubt reduces the efficiency of the Iowa pasture during the autumn months fully one half, the weeds of corn fields frequently cut the yield one third. How these yields are reduced has not been determined. How much do we know about the mechanical interference of weed roots and the agricultural crop? So far as I know, there is absolutely no data on the subject. Water is an important factor in crop production; therefore, a study of transpiration is of importance in connection with a study of weeds. It has been pointed out by Livingston that transpiration is practically a simple function of the leaf surface and that the total transpiration is a measure of the growth of a plant, whether it is one growing in a waste place or of economic importance.

Kesselback makes it clear that weeds such as sunflower use more than three times as much water per plant as corn. while water used per

unit of dry matter was slightly more than double that of corn. In other words, a sunflower plant will consume as much water as a hill of corn. Brenchly in a recent publication states that weeds like mustards did better when they were associated with other plants, than when they were subjected to competition with their own species. Wheat is not so well able to overpower the *Brassica* and reduce its growth as is the case with some other weeds. Mustard would then, according to Brenchly, even in moderate amounts do considerable damage.

Possibly in the majority of places, even in the agricultural areas of the middle west, there are times in which there is not enough water to supply the needs of the plant. Water is used by a plant in large quantities and practically all of it passes off in the transpiration stream. Water being an important item, its conservation is a question which we must be concerned with. From the few citations given above we conclude that weeds do considerable damage to growing crops by consuming the moisture. Knowing that transpiration or the giving off of water by the aerial portions of a plant goes hand in hand with the leaf area, a study in which the leaf area and transpiration are measured from time to time at specific intervals should give us much information concerning the effect of weeds upon the crop in which they are associated, both in the greenhouse and in the field.

Some preliminary work done in plant physiological laboratory at Ames by Bakke shows that the matter of transpiration by weeds is an important item in crop production. In these experiments wheat, oats and mustard were grown together and, with one exception, it was found that the total transpiration for the mixed cultures is greater than for the pure wheat and oats cultures. The present study shows that wheat transpires during the growing season more than oats.

ECOLOGICAL PROBLEMS

Another phase of economic botany has interested me very much, namely the relation of plants to soil. This requires the best kind of taxonomic work if the ecological investigations are to be correctly interpreted. The national government in cooperation with various states is spending large sums of money to study soils. It is a good kind of investigation. The soils are carefully mapped on a scale as never before. The plant is an index of what the soil will produce and the aim of this work is to help the farmer. I am sure it does; and why should the botanists not cooperate with the geologist, and the soil expert make just as detailed a study of the plant life as the geologist does of the soil. In no place in the world can this problem be studied better than in the prairie states. There is scarcely anything left of the great prairie domain, except as we find it along the right-of-way of railroads. Should not a group of botanists in these prairie states study the ecological and taxonomic phases of the richest, virgin, agricultural soil in the world, as Shimek is now doing for the prairie plants of Iowa. What we need is a crop ecologist, who after a study of the problem, can tell the farmer just what crops can be grown together or what crops are best suited for his soil. Let us as botanists seek a closer cooperation with the soil expert.

I am reminded that Dr. Cowles in an address before this section called attention to the use of an ecologist to settle a legal question involving a large amount of money in regard to a meandered lake in Arkansas where a study of the problem by the ecologist disclosed the truth that the so-called lakes had been covered with trees much antedating the survey made by the government. I am told that in some surveys along the Mississippi the government instructions are to include all land to the limit of apparent line of vegetation. Who should determine the apparent line of vegetation; the surveyor, who generally knows nothing about succession, or the ecologist? It would seem to me, the ecologist.

EROSION

In a prairie state like Iowa every available area has been brought under cultivation, or the wooded areas have been turned into

pastures. Millions of dollars worth of the very best soil in this great agricultural region are annually carried down the Mississippi, finally helping to increase the area of Louisiana, or to fill up the channel of the Mississippi River. The government to prevent disastrous floods builds levees. The water, under our present system of intensive agriculture, is rushed off as rapidly as possible, the little lakes are filled up with silt from the neighboring drainage area or they are drained. Drainage no doubt does help crop production but the water table has dropped twelve feet, according to McGee, in fifty years in Iowa. Now if the water table will show a further drop it is a question of vital concern to the agriculture of Iowa. Have we any plant physiological data to show how this has influenced crop production or the growth of trees? The botanist can do a real service by making a study of the movement of water in the soil and its relation to plant growth. We know that the climatic and edaphic relations of forests are important. Zon has given us a comparative study of the problem in his paper on "Forests and Water in the Light of Scientific Investigation." Then we may also recall the work of Pearson on the "A Meteorological Study of Parks and Timbered Areas in the Western Yellow Pine Forests of Arizona and New Mexico." and the work of Hall and Maxwell, Bray and Schwartz on forests and streams flow.

In order to determine the problem of water conservation and forest conservation, I. T. Bode made an investigation in one of our park areas in Iowa. The results are interesting, as showing the close relationship between forest cover and soil moisture. The results show unmistakably, even in a small area, that the forest cover keeps greater quantities of water in the upper soil layers, that these forest areas maintain a higher water level in the soil.

The conclusion to be drawn from the work and some done by others of the Forest Service is that all hills subject to erosion should be covered with timber.

AQUATIC FARMING

I have been more or less interested in the preservation of our lakes, not only because the community and state will receive the benefit of recreation, but our lakes and streams should furnish an important source of food, and also a source of income from the fur-bearing animals. The botanist should make more study of the food for fish and game. It is said that the little muskrat in Iowa has become so depleted that it will be necessary to have a closed season. Much of this depletion is no doubt due to trapping, but may not the food supply have some bearing on the problem? Take for instance the water-lily, which has become a somewhat rare plant in Iowa. How far does this plant and the lotus minister to the food of this little rodent? Sportsmen are agreed that wild rice and wild celery are very important food plants for the wild duck. Schofield has given us a practical method of germinating wild rice, yet we know almost nothing about the maximum yield of this plant and how it might be increased. There are millions of acres of land suitable for the growing of wild rice in the United States, especially in the northern Mississippi valley. It should be used more extensively for human food than it is to-day. We know little about the uses of aquatic plants by animals. May we not breed a variety of wild rice which will cling somewhat more tenaciously to the rachis? Some plant breeder should undertake the selection of plants with this in mind.

COOPERATIVE WORK

We have never in the history of the world had as much productive research work as now, although there may be a slight curtailment since the war. Our various journals, like the *Botanical Gazette, American Journal of Botany, Bulletin Torrey Botanical Club, Journal of Agricultural Research* and various publications from experiment stations, national government and academies of science are publishing an enormous amount of good material. All state, national and private agencies are working to increase the amount

of research. Cooperation seems to be the slogan to-day and the National Research Council, created as a war measure, is functioning to stimulate research in all of these institutions of the country in a cooperative way. Botany certainly has not been neglected as evidenced by the fundamental physiological work on fertilizers and the growing of wheat, and the fundamental work in connection with the treatment of plant diseases which will be taken up by the Research Council through the Crop Protection Institute in a cooperative way. Cooperation in every line is desirable, but is it not a fact that all great discoveries are made by individuals? These individuals should have plenty of equipment and help, and each should have a free hand to work out his or her problem.

In conclusion the plea I desire to make is that the botanist should enter more vigorously into the exploitation of fields of agronomic work, ecology and taxonomic work, as it is related to horticulture and agriculture. We have allowed some splendid fields of work to slip away from us, largely because we were indifferent to the problems of agriculture. This is not true of plant pathology which has made itself felt along economic lines. It is true that some phases of plant breeding, physiology and soil relations of plants are masquerading under various forms of agriculture and horticulture. It is not my aim to belittle much that has been accomplished by horticulturists and agriculturists, but this work, when botanical, should finds its place under the head of botany. Let us look for a new era in botanical work. Then the various phases of the work will find their rightful place, not only in our teaching, but in our research as well.

L. H. PAMMEL

IOWA STATE COLLEGE

SCIENTIFIC EVENTS

THE BOWDOIN MEDICAL SCHOOL

THE Bowdoin Medical School, established a century ago by Maine's first legislature, will be closed as a department of Bowdoin College at the end of the current year next June, unless by that time it receives financial support.

The following announcement has been made by President Kenneth C. M. Sills by authority of the boards of trustees and overseers.

By action of the board of trustees and overseers the Bowdoin Medical School will be finally closed as a department of Bowdoin College at the end of the current year, June, 1921, unless by that time some way shall be found to meet the requirements necessary to keep the school in Class A of American medical colleges. It has been conservatively estimated that for this purpose there must be an addition to the resources of the school of $25,000 for immediate equipment of laboratories and of at least $50,000 yearly income for more teachers and for up-keep. Unfortunately at the present time the college sees no way of procuring such funds; the need of such an endowment has often been placed before the people of Maine, but the appeals have never received an adequate response.

The college will not apply for state aid for the school. But if the citizens of Maine and the friends of medical education who believe that the maintenance of a medical school is properly a state function, desire to have the medical school reestablished as a state institution under state control and adequately supported by the state, Bowdoin College will be glad to give all assistance possible to that end, and would doubtless offer for such a purpose for temporary use, if desired, such part of the buildings and apparatus of the college as might be available.

The trustees and overseers of the college believe that there is a place for a medical school in Maine and are hopeful that the people of the state, despite the great demands on the incoming legislature, will establish such a school as a state institution, around which all the medical and public health work of the state would be centered.

THE DIRECTORSHIP OF THE BUREAU OF MINES

DR. F. G. COTTRELL, director of the United States Bureau of Mines, on December 31, handed his resignation to the President, through Secretary of the Interior Payne. He leaves the bureau to take up his duties as chairman of the Division of Chemistry and Chemical Technology of the National Research Council. Dr. Cottrell recommends as his successor H. Foster Bain, of California, whose

name was formally presented to the President. In his letter of resignation, Dr. Cottrell said:

I hereby tender you my resignation as director of the Bureau of Mines, to take effect January 1, 1921.

In so doing, may I recall to your mind that, in accepting this position upon the resignation of Director Manning last June, I explained to the secretary of the interior that I had previously made all my plans to resign from the position I then occupied as assistant director and to give my undivided attention to the position of chairman of the Division of Chemistry and Chemical Technology of the National Research Council, which I had accepted as successor to Professor W. D. Bancroft, who was retiring July first.

I accepted appointment as director of the Bureau of Mines on the understanding with Secretary Payne that I would continue therein until an available successor should be found who was thoroughly acceptable to him and to the mining industry.

The time having now arrived when Secretary Payne is ready to recommend a successor, I am placing my resignation in his hands for transmittal to you.

It is with the pleasantest recollections that I look back over my decade of service in various capacities within the bureau, and as the greater part of this time has fallen within your own administration, it gives me particular pleasure to tell you of the uniform courtesy and high standard of public service which I have always encountered in my contact with both associates and superiors throughout the whole department.

It would be with very deep feelings of personal regret that I should take the present step were it not that the position in the Research Council will still permit me to cooperate very closely with those particular aspects of the bureau's work for which I feel myself best fitted.

At the same time Secretary Payne handed to the President the appointment of H. Foster Bain, of California, as successor to Dr. Cottrell.

Mr. Bain was educated and trained as a geologist and mining engineer. He was one of Herbert Hoover's assistants in London on the Belgian relief work during the war. Before that he was editor of the Mining and Scientific Press of San Francisco, Calif., and later the editor of the Mining Magazine of London, England. He made some important mining investigations in south and central Africa and later undertook similar investigations in China. At one time he was a mine operator in Colorado and once was connected with the United States Geological Survey. Subsequently, he was the first director of the Geological Survey of Illinois. For a time during the war Mr. Bain was assistant director of the United States Bureau of Mines, following up production and manufacture of metal products, explosives, and other chemical substances for war purposes. At the close of the war Mr. Bain returned to private life. Mr. Bain was born at Seymour, Indiana. Graduating from Moore's Hill College, Indiana, in 1890, he spent two years at Johns Hopkins University and later received his doctor's degree from the University of Chicago.

INTERNATIONAL EUGENICS CONGRESS

In 1912 there was held in London, under the auspices of the Eugenics Education Society, an International Eugenics Congress. A second congress was planned to be held in New York City in 1915 but, on account of the war, plans for the congress were abandoned. In the autumn of 1919, at a meeting of the International Committee of Eugenics held in London, it was agreed to hold the second International Congress in New York City in 1921. A general committee to arrange for this congress was selected by the National Research Council in the spring of 1920, and it is now announced that the preliminary announcement of the Second International Congress of Eugenics will be held in New York City, September 22–28, 1921.

Of this Congress Dr. Alexander Graham Bell is honorary president; Dr. Henry Fairfield Osborn, president; Mr. Madison Grant, treasurer; Mrs. C. Neville Rolfe (Mrs. Sybil Gotto) honorary secretary; and Dr. C. C. Little, secretary-general. The vice-presidents include Dr. Cesare Arton, Cagliari Italy; Dr. Kristine Bonnevie, Institute for Heredity Investigation, University of Christiania, Norway; Major Leonard Darwin, London; Dr. V. Delfino Buenos Aires; Dr. E. M. East,

Harvard University; M. Gamio, Director Archeology and Anthropology, Mexico; Sir Auckland Campbell Geddes, British Ambassador to the United States; Dr. Corado Gini, Rome; Hon. Mr. Justice Frank E. Hodgins, Supreme Court of Ontario; Dr. Frédéric Houssay, Paris; Dr. H. S. Jennings, Johns Hopkins University; G. H. Knibbs, Melbourne; Dr. Herman Lundborg, Upsala; Dr. L. Manouvrier, Paris; M. L. March, Paris; Dr. Jon Alfred Möjen, Christiana; Dr. T. H. Morgan, Columbia University; Dr. R. Pearl, Johns Hopkins University; Dr. Edmond Perrier, Paris; Dr. Ernesto Pestalozza. Rome; Dr. V. Guiffrida-Ruggieri, Italy; Professor R. Vogt, University of Copenhagen; and Professor Wille, University of Christiania.

The Finance Committee has been selected consisting of Messrs. Madison Grant, John T. Pratt, Austin B. Fletcher, and Dr. John H. Kellogg. Of the Exhibits Committee Dr. H. H. Laughlin is chairman; of the Publicity Committee, Dr. Lothrop Stoddard; and of the Executive Committee, Dr. C. C. Little. A general committee of ninety-five members has been appointed. There are to be two classes of members, sustaining members paying one hundred dollars and active members paying five dollars. Further information and a copy of the preliminary announcement can be obtained from Dr. C. C. Little, Secretary-General, American Museum of Natural History, New York City.

THE AMERICAN ENGINEERING COUNCIL

THE Engineering Council, formed in 1917 as an emergency body to place at the disposal of the government in war the organized engineering talent of the nation, has been formally merged into the American Engineering Council of the Federated American Engineering Societies.

Mr. Herbert Hoover, who becomes president of the amalgamated organizations, and the four vice-presidents, Calvert Townley, of New York; William E. Rolfe, of St. Louis, Dean Dexter S. Kimball, of Cornell, and J. Parke Channing, of New York, have issued a statement in which it is said that the new council will immediately enter upon a campaign of public service, involving cooperation with chambers of commerce, labor organizations and other bodies in an effort to solve pressing social, industrial and political problems.

The appointment of several committees to handle national problems is announced. One on military affairs is headed by Colonel William Barclay Parsons, chairman of the trustees of Columbia University. D. L. Hough, of New York City, has been named to head a Russian-American committee, which, it was explained, is in no sense political, but will aim to bring the engineers of the United States and Russia closer together. A patents committee, which will work for an increase in both the pay and personnel of the United States Patent Office, has been appointed, with E. J. Prindle, of New York as chairman. Other committees chosen thus far are: Classification and Compensation of Engineers, Arthur S. Tuttle, of New York, chairman; National Board of Jurisdictional Awards in the Building Industry, Rudolph P. Miller, of New York, chairman; Cooperation with American Institute of Architects, S. H. Senehon, of Minneapolis, chairman; Payment for Estimating, Ralph Modjeska, of Chicago, chairman; Types of Government Contract, Arthur P. Davis, of New York, chairman. These committees, with others to be appointed, will start at once to carry out a constructive program of national progress.

SCIENTIFIC NOTES AND NEWS

IN 1816, John Scott, a chemist of Edinburgh, bequeathed the sum of $4,000 to the City of Philadelphia, the interest upon which was to "be laid out in premiums to be distributed among ingenious men and women who make useful inventions." The Board of Directors of City Trusts of Philadelphia, has awarded $800 together with a bronze medal to Dr. Hideyo Noguchi, of the Rockefeller Institute, for Medical Research in New York, "in recognition of his eminent work in the discovery of disease-producing organisms and the means of combating their action." A similar award has been made to Dr. Edward

Calvin Kendall, of Rochester, Minn., "For biochemical work of high order leading to the preparation of the compound 'thyroxin' and the determination of its chemical structure and giving results which contribute to the comfort and welfare of mankind."

Professor Stephen A. Forbes, of the University of Illinois has been elected president of the Ecological Society of America.

At the recent Chicago meeting of the American Psychological Association, Professor Margaret Floy Washburn was elected to the presidency.

Dr. William Blum, of the Bureau of Standards has been elected president of the Washington Section of the American Chemical Society.

Dr. F. M. Perkin has received the honor of the order of commander of the British Empire. Dr. Perkin is one of the leading authorities upon the scientific treatment and utilization of coal and the production of oil from it.

The Italian Society of Sciences has awarded its gold medal for 1920 to Professor A. Signorini, of the University of Palermo, for his papers published during the last year.

Dr. C. O. Johns, chief of the color and protein laboratories of the Bureau of Chemistry of the Department of Agriculture, has resigned to accept the offer made him by the Standard Oil Company of New Jersey, to be director of the research laboratory of the company.

Mr. H. D. Foster has been appointed research associate at the Bureau of Standards by the Hollow Building Tile Association.

Assistant Surgeon-General J. H. White, U. S. P. H. S., after the close of the sixth Sanitary Conference of the American Republics, to be held in Montevideo, Uruguay, will proceed to Valparaiso, Chile, and other points on the West Coast of South America, via Panama, for the purpose of investigating sanitary conditions at the various ports.

Commander Cope, leader of the British Antarctic Expedition, is detained in Montevideo through the non-arrival of his dogs. He is also encountering difficulty in obtaining films owing to their unexpected cost. He proposes to give lectures at Montevideo and at Buenos Aires, thus obtaining assistance from the British communities. He will probably proceed south early in December in the whaler *Solstreif*, without waiting for the dogs, although their absence makes sledging more difficult.

Professor J. W. E. Glattfeld, of the department of chemistry of the University of Chicago, will spend his winter quarter vacation at the Desert Laboratory of the Carnegie Institution at Tucson, Arizona.

Dr. Julius Stieglitz, of the University of Chicago, has delivered three lectures on the Mayo Foundation at Rochester, Minnesota. The first was on "Chemistry and Medicine," and the other two were on "The Electrical Theory of Oxidation."

A lecture was delivered at the School of Hygiene and Public Health of Johns Hopkins University, December 13, by Dr. Charles Wardell Stiles, U. S. P. H. S., on "Some Practical Aspects of the Subject of Soil Pollution."

Dr. Alfred F. Hess, of the New York University and Bellevue Hospital Medical College, will deliver the fifth Harvey Society Lecture at the New York Academy of Medicine on Saturday evening January 15. His subject will be "Newer Aspects of Some Nutritional Disorders."

Dr. Yves Delage, professor of zoology in University of Paris, distinguished for his work on protoplasm, heredity and general biology, has died at the age of sixty-six years.

Professor G. M. Debove died on November 19, at almost seventy years of age. He is known for his work on diseases of the stomach and for the past seven years has been permanent secretary of the Paris Academy of Medicine.

At the annual meeting of the Society of American Foresters held in New York City

on December 20, the following officers were elected for 1921:

President, R. C. Bryant, 360 Prospect St., New Haven, Conn.

Vice-president, Paul G. Redington, Ferry Bldg., San Francisco, Calif.

Secretary, Paul D. Kelleter, Atlantic Bldg., Washington, D. C.

Treasurer, E. H. Frothingham, Atlantic Bldg., Washington, D. C.

AT the recent meeting of the Indiana Academy of Sciences the officers were elected for 1921 were as follows:

President, Howard E. Enders, West Lafayette.

Vice-president, Frank M. Andrews, Bloomington.

Secretary, Walter N. Hess, Greencastle.

Assistant Secretary, H. G. Dietz, Indianapolis.

Treasurer, Wm. M. Blanchard, Greencastle.

Editor of Proceedings, F. J. Breeze, Muncie.

Secretary, F. B. Wade, Indianapolis.

THE American Pharmaceutical Association has elected the following officers:

President, Samuel L. Hilton, Washington, D. C.

First Vice-president, Charles E. Caspari, St. Louis, Mo.

Second Vice-president, David F. Jones, Watertown, S. D.

Third Vice-president, Hugo H. Schaefer, New York.

Members of the Council, Henry M. Whelpley, St. Louis, Mo.; George M. Beringer, Camden, N. J.; John G. Godding, Boston, Mass.

THE U. S. Civil Service Commission has announced examinations for the positions of junior engineer and deck officer in the U. S. Coast and Geodetic Survey to be held February 9–10 and April 13–14, 1921. These positions are the entering ones in the field force of the Coast and Geodetic Survey and the initial salary will be $2,000 per annum, with a promise of increase to $2,400 after one month of satisfactory service. From these entering positions engineers will be promoted after six months of satisfactory service to the commissioned grades of the Survey which have relative rank with the grades from ensign to captain in the navy. The salaries of the commissioned personnel, including compensation for quarters, etc., and longevity pay, vary from a minimum of $2,500 to approximately $7,000 per annum. There are now about fifty vacancies in the commissioned grades which will be filled by promotion from the eligibles secured from the examinations to be held in February and April. Applicants for this examination should communicate with the Civil Service Commission or with the Director of the Coast and Geodetic Survey, Washington, D. C. A civil engineer degree or B.S. in civil engineering is required of an applicant before appointment, but the examination may be taken in February or April and the appointment made effective on graduation.

THE Laws Observatory of the University of Missouri, erected in 1853, has been torn down, and a new building is being erected to replace it about half a mile south of the former site.

INCLUDED among the bequests of the late Dr. Lloyd Roberts of Manchester, England, are the following gifts to medical organization: to the Royal Society of Medicine, £5,000; to St. Mary's Hospital, Manchester, £5,000; to Manchester Royal Infirmary and to the Royal College of Physicians, London, £3,000 each; and £2,000 to the Medical Society of London.

UNIVERSITY AND EDUCATIONAL NEWS

THE University of Montpellier, which was founded in the thirteenth century, is preparing for the celebration of its approaching seven hundredth anniversary.

THROUGH the death of Mrs. Lucy H. Bowdoin, of Salem, a bequest of $50,000 becomes available for Harvard Medical School, and $5,000 each will be given to the Essex Institute and Peabody Academy of Salem.

IT is planned to establish a technical school at Oberlin College with accommodations for about 700 students.

FIRE, supposed to have originated from the furnace in a basement room, completely destroyed the office and private laboratory of Dr. Waddell, professor of pharmacology, and a large amount of physiological apparatus in the physiological laboratory of the University of

Virginia on the morning of December 24. The loss is largely, if not entirely, covered by insurance and there will be little interruption to the regular laboratory work.

The inauguration of President Wallace D. Atwood, of Clark College, will take place on February 1. Presidents and representatives from more than two hundred colleges have signified their intention of being present at the exercises.

Dr. Henry Rand Hatfield, professor of accounting on the Flood Foundation in the University of California, has been appointed dean of the faculties of the State University of California to succeed Professor John C. Merriam, who resigned to accept the presidency of the Carnegie Institution in Washington.

At the College of the City of New York, Professor Herbert R. Moody has been appointed professor of chemical engineering within the department of chemistry; Assistant Professor W. L. Prager has been promoted to an associate professorship, and Mr. Joseph A. Babor has been promoted to an instructorship.

Dr. Ardrey W. Downs, formerly assistant professor of physiology at McGill University, has been appointed to the chair of physiology in the University of Alberta.

DISCUSSION AND CORRESPONDENCE

ANTHROPOMETRIC MEASUREMENTS

During the sessions of two International Congresses of Anthropology, in 1906 at Monaco, and in 1912 at Geneva, rules were drawn up for the standardizing of the more usual anthropometric measurements. The work was undertaken in each case by a committee, and the official reports were published by certain members to whom this duty was assigned.

The prescription of 1906 included measurements of the skull and of the head and facial features of the living. It was published in the French language by Dr. Papillault and appeared in the pages of *L'Anthropologie* (Vol. 17, 1906, pp. 559–572). The prescription of 1912 was the work of a larger and more representative committee, which aside from French, German and Italian members, included representatives of Great Britain, the United States, Russia, and Switzerland, countries not included in the former report. The official reporters of this prescription, which included measurements of the living body, exclusive of those of the head and face, were Drs. Rivêt, Schlaginhaufen and Duckworth, who published their reports in French, German and English, respectively.

Having these data in mind I was led to state, in the preface to my recent "Manual of Anthropometry," that the official reports of the prescription of 1912 were published only on the other side of the Atlantic, and appeared in an American journal for the first time in 1919, when Dr. Duckworth's official report was reprinted by Dr. Hrdlička in his new *American Journal of Physical Anthropology*.

While this statement, concerning the three *official* reports only, is strictly true, I should have mentioned that equally accurate and trustworthy reports were published in other countries, and especially should I have cited that of Dr. MacCurdy, also a member of the committee. His report in full of the prescription of 1912 was translated at the time of the Congress for Dr. Rivêt's official copy, and appeared, later in the same year, in both Science and the *American Anthropologist*. Had I noticed this earlier, I should certainly have brought it to the attention of the readers of my book, and wish to take this opportunity to rectify my unintentional neglect.

The citations referred to are the following:

Science: N. S., Vol. 36, No. 931, Nov. 1, 1912, pp. 603–608.

Amer. Anthropol., Vol. 14, No. 4, Oct.–Dec., 1912, pp. 621–631.

Harris Hawthorne Wilder
Smith College,
Northampton, Mass.,
December 17, 1920

A NEW DIKE NEAR ITHACA, N. Y.

Considerable attention has been given by geologists to the dikes of central New York.

Each newly discovered one is of interest and perhaps a note should be made of the occurrence of a rather large dike recently found. It has been exposed at the eastern side of the Portland cement quarry east of Shurger Point, six miles north of Ithaca. It is the first of the Ithaca region dikes found in limestone and is exposed for the height of the Tully limestone at the north and south walls of the quarry and in the shales along the quarry bed.

No contact action was noticed. In places there is a thin calcite streak at the side of the dike, in others there is a tight contact between dike and wall rock. Striæ on the calcite gave evidence of horizontal movement. The dike varies in width from 11″ to 18″ and is decidedly green, due to the serpentine in it. It strikes about N 3° E., parallel to the dip joints, like all the dikes near Ithaca. There may be some connection between this dike and a group of smaller dikes east of Ludlowville, two miles to the north.

PEARL SHELDON

CORNELL UNIVERSITY

THE HAWAIIAN OLONA

TO THE EDITOR OF SCIENCE: In SCIENCE[1] for September 10, 1920, p. 240, Mr. Vaughan MacCaughey again calls attention to the remarkably durable fiber of the Hawaiian Oloná, and quotes Dr. N. Russel's rather inaccurate account of the people making the fiber and its products, fish nets and cords, some used especially for fish-lines. In view of the possible importance of this product, it seems worth while to correct certain statements. The name of the bird caught for its yellow feathers was O-o not O-u. As late as 1864, when the present writer first visited the Hawaiian Islands, there were some natives at Olaa still beating the mamake kapa and twisting the oloná fiber on their thighs. On the island of Molokai, as late as 1889 a photograph was taken of a native scraping the fiber. Surely Mr. MacCaughey must be aware that in the Bishop Museum in Honolulu, is a fine cast from life of a native preparing this fine fiber, and there are many specimens of both the raw material, the finished product and the *laau kahioloná* or scraper which was sometimes a shell *papaua* (*Meleagrina margaritifera*) but more commonly a sharpened bone from the back of the *honu,* a sea turtle not a (fish, as Dr. Russel has it). The boards were made of any hard wood; the *naou* of Dr. Russel was perhaps the *naio,* or bastard sandalwood.

As a specimen of the remarkable durability of the fiber, there is in the Bishop Museum a ball of fish-line used by the Kamehamehas for a hundred years and it is still in perfect condition.

WILLIAM T. BRIGHAM

[1] N. S., Vol. LII., No. 1341.

QUOTATIONS

PROFESSOR MICHELSON ON THE APPLICATION OF INTERFERENCE METHODS TO ASTRONOMICAL MEASUREMENTS

THE first information Professor A. S. Eddington, Plumian professor of astronomy at Cambridge University, received that his theoretical deductions concerning the angular diameters of certain stars and of the Betelgeuse, in particular, had been confirmed by Professor Michelson [in his paper at the Chicago meeting] was from a cable message from the *New York Times.* He was extremely interested and delighted at the results obtained and is anxiously awaiting full details.

Talking to the *New York Times* correspondent he pointed out that many years ago Professor Michelson suggested a plan for measuring, at any rate to a much greater degree of accuracy than before, diameters of stars by the wave theory of light.

"For some time now," he said, "they have been carrying on these experiments at Mount Wilson, and I presume that it is there that these most interesting results have been obtained. The great difficulty that they have had to contend with has, of course, been what is known as atmospheric tremor. They have been trying Michelson's methods and previously had obtained some very interesting results, but these were only with regard to very close double stars. By this means they got some very successful results with double stars, but when they

came to try to determine the angular diameter of stars they were up against a very much more difficult problem. I knew that they were working on these lines, but this is the first word I have heard of the results.

"At a meeting of the British Association I delivered a presidential address to the mathematical and physical sections, and made reference to the fact that this experiment which was being carried out would be of the very greatest importance. We have of course had theories, and, working on those theories, I gave a table of what I thought would be the angular diameter of certain stars, and I am delighted to find that the figures so nearly correspond. This would seem to show the theories have been on the right side.

"In particular, I noticed that Betelguese's diameter is 260,000,000 miles, which is enormously larger than the sun. That is a very interesting confirmation of the theory of Russell and Hertzsprung of giant and dwarf stars, giving direct evidence that Betelguese is one of the inflated stars and very different from the sun."

Dr. A. C. Crommelin, chief of staff of the Greenwich Observatory, was interviewed today on Professor Michelson's discovery by *The Evening Standard* and expressed the interest the experts in England's principal observatory took in it.

"Star diameters have been calculated hitherto," he said, "but have never before been actually measured. Michelson's announcement that he has measured Alpha Orionis and found it to have a diameter of 260,000,000 miles, 300 times bigger than the sun, is hopeful.

"That the distance from the earth of such a star as Alpha Orionis, which is 900,000,000,000,000 miles away, should have been measured so long ago and the size of the star should remain unmeasured seems strange, but it was explained at the offices of the Royal Astronomical Society that the two measurements have to proceed on entirely different lines.

"The Astronomical Society confirms Dr. Crommelin in the expectation of good results from Professor Michelson's work. For some time past he and his work have loomed increasingly large in the astronomical world.—Cablegram to the *New York Times*.

CAUSES OF CLIMATIC OSCILLATIONS IN PREHISTORIC TIME, PARTICULARLY IN THE ICE AGE[1]

In 1918 Professor Arldt, of Radeberg, grouped the theories and weighed the evidence which had been proposed by 117 scientists in the past sixty years on the causes of the glacial and interglacial epochs. As none of these hypotheses are in all respects satisfactory, in his opinion, or can claim to explain thoroughly all paleo-climatic phenomena, he does not recognize any one theory or group of them. This is not surprising since the fundamental conclusions underlying these hypothesis have not been reached.

In this paper of twenty-seven pages, Arldt does not give an exhaustive explanation of the numerous hypotheses which have been proposed but a brief statement concerning the most important groups among them. He distinguishes two classes, Cosmic and Telluric, with three subdivisions for the first: Universal, Solar and Telluro-Cosmic; and five for the second: Dislocation of the Poles, Atmospheric, Intra-Telluric, Actologic and Orographic. Although discussions and opinions are to be found under each of these headings, his main contribution appears in crystallized but abbreviated form in his conclusion, thus:

> Among numerous theories explaining the changes in climate of the earth, those should be given preference which are based upon the hypothesis that the factors which are of importance to-day in determining climate have always been effective. . . . Most importance is attached to Ramsay's theory which emphasizes most strongly the direct and indirect action of the mountains. Besides these orogenetic forces other elements, as enumerated below, probably aided in the generation of the ice ages.
>
> 1. The rise of extensive mountains (Ramsay).
> 2. The formation of ocean basins (Arldt).
> 3. The sinking of the entire ocean floor and the

[1] Theodore Arldt, "Die Ursachen der Klimaschwankungen der Vorzeit, besonders der Eiszeiten," *Zeitschrift für Gletscherkunde*, Band XI., s. 1–27, 1918.

corresponding elevation of continents (Arldt and Enquist).
4. Intensive volcanic activity with accompanying soot clouds (Sarasin).
5. Slight eccentricity of the earth's orbit (Hildebrandt).
6. Passing of the solar system through regions of the universe in which there were no stars (Noelke).
7. Decreased heat radiation of the sun (Philippi).
8. Lesser inclinations of the ecliptic (Eckholm).
9. Decrease of carbon dioxide content in the air (Chamberlain and Salisbury).

(6–9: Accessory.)

10. Distribution of land and sea according to Kerner's view.

Pliothermal or warm interglacial periods occurred under the following circumstances:

1. Chiefly as a result of low flat continents,
2. Through absence of deep basins,
3. Rising of sea floor and depression of continents,
4. Volcanic inactivity,
5. Great eccentricity of the earth's orbit,
6. Passing of the solar system through regions of the universe abounding in stars,
7. Great radiation of heat from the sun,
8. Great inclination of the ecliptic,
9. Increase of the carbon dioxide content of the air.

It is utterly improbable that the interior of the earth contributed to the climatic changes. Polar dislocations are also out of the question, so long as we can not prove that they followed any particular direction. All attempts, likewise, at explaining change in climate from one cause alone are futile. Although at first sight these theories may appear attractive, they can not stand the test of keener criticism. Moreover, nature is too complex to permit its being compressed into a single formula.

CHESTER A. REEDS
AMERICAN MUSEUM OF NATURAL HISTORY

SPECIAL ARTICLES

OBSERVATIONS ON THE ACCUMULATION OF CARBON DIOXIDE FROM STRAWBERRIES IN REFRIGERATOR CARS

DURING the years 1918 and 1919 and in connection with shipping tests of strawberries in refrigerator cars being made under the direction of Mr. H. J. Ramsay and Mr. V. W. Ridley then of the Bureau of Markets, the writer was able to make observations on the carbon dioxide and oxygen content of the air in refrigerator cars and the effect of ventilation on the accumulation of carbon dioxide. A brief summary of the results follows:

The percentage of carbon dioxide and of oxygen was determined by means of a commercial Orasatt apparatus—samples being drawn through lead tubing one end of which was placed in the part of the car from which it was desired to take samples and the other run out at one corner of the door. During transit analyses were made at icing stations and at other times when the train stopped long enough. Duplicate analyses were made when time permitted, and in all cases several hundred cubic centimeters were thrown away before the sample was drawn for analysis.

The results of the analyses made during three of these tests are summarized in Table I. In the tests of 1918 the berries were loaded at a temperature of about 68° to 70° F. and one car was ventilated by raising the hatches at diagonal corners of the car. The berries loaded in the test of 1919 were at a temperature of 76°–78° F., one car being ventilated by raised hatches, and the other that reported in the last column of Table I., by two six-inch pipes, installed at opposite ends of the car.

From the table it is apparent that there is no great accumulation of carbon dioxide in the air of the unventilated cars in transit. The maximum amount 2.5 per cent., was reached in a car loaded at Monett, Mo., seven hours after the doors were closed. When the car was re-iced the carbon dioxide content dropped to 0.7 per cent. From this it increased again to 1.3 per cent., but at the next icing it dropped to 0.6 per cent. and never exceeded this amount during the remainder of the trip.

The accumulation of carbon dioxide in unventilated refrigerator cars loaded with strawberries has been found not to exceed 2.5 per

cent. by volume and is usually less. Moreover, when the cars are re-iced the air in the cars is renewed to some extent and the accumulated carbon dioxide largely swept away. In ventilated refrigerator cars the percentage of carbon dioxide is lower. It may, while the cars are standing after being loaded, become nearly or quite as great as in unventilated cars. When the cars are moved it drops to 0.2–0.4 per cent. and rarely exceeds that amount.

TABLE I

Accumulated Carbon Dioxide, Expressed in per cent. by Volume, in Refrigerator Cars Loaded with Strawberries

Approximate Number of Hours After Loading	Shipment Monett, Mo., to St. Paul, Minn., 1918		Shipment Bowling Green, Ky., to Pittsburgh, Pa., 1919		Shipment Bowling Green, Ky., to Pittsburgh, Pa., 1919	
	Unventilated	Ventilated	Unventilated	Ventilated	Unventilated	Ventilated
1	1.6	—	1.0	0.7	0.7	0.2
2	—	0.2	1.1	1.0	1.0	—
3	—	0.2	1.3	—	—	—
4	1.8	—	1.4	1.4	—	—
5	—	—	—	—	—	0.3
8	2.5	—	—	—	—	—
	0.7[1]					
9	—	—	—	—	1.4	—
11	—	—	0,4[1]	0.4[1]	—	—
19	1.3	0.6	0.3	0,2	0.3[2]	—
	0.6[1]					
30	—	—	—	—	0.4	0.4
34 (also) 47	—	—	0.3	0.2	—	—

The accumulation of carbon dioxide in unventiated refrigerator cars is apparently not sufficient, with strawberries, to cause injury to the berries.

H. F. Bergman

Bureau of Plant Industry,
Washington, D. C.

THE AMERICAN CHEMICAL SOCIETY

(*Continued*)

The preparation and analysis of a cattle food consisting of hydrolyzed sawdust: E. C. Sherrard and G. W. Blanco. Investigations carried out at the Forest Products Laboratory indicate that a cattle food can be prepared from eastern white pine sawdust and that it has considerable food value. The cattle food was prepared by digesting the sawdust for 15 to 20 minutes with 1.8 per cent. sulphuric acid at a steam pressure of about 120 pounds per square inch. After cooking the sugars were extracted with water and the acid removed from the solution by means of lime. The liquor containing the sugar was evaporated to a thick syrup and mixed with the digested residue which had been previously dried. The whole was then dried to a moisture content of 15 per cent. It is shown that when the product has a greater moisture content than 15 per cent. the keeping qualities are not good. Leaching experiments removed all but 2.04 per cent. of the total acid and all but 7.16 per cent. of the total sugar. A comparative analysis of the wood before and after conversion shows that cold water soluble, hot water soluble and NaOH soluble substances are greatly increased but the ether soluble substances are almost unchanged by the treatment. The pentoses are reduced 46.4 per cent. while the methyl pentosans are not affected. The total cellulose is reduced by 21.68 per cent. The sugars produced correspond to 71.5 per cent. of the cellulose removed by the digestion. The lignin content is unchanged. The crude fiber corresponds to about 75 per cent. of that in the original wood. The cellulose is greatly altered by the treatment. Practically the whole of the cellulose obtained is soluble in 17.5 per cent. alkali. It is reprecipitated from the alkaline solution by dilution with water. After filtering no precipitation of beta-cellulose is obtained upon acidification with strong acetic acid.

A comparison of wood cellulose and cotton cellulose: S. A. Mahood and D. E. Cable. Samples of wood cellulose and cotton cellulose which had been subjected to various conditions of cooking and bleaching were analyzed by determining a number of constants on them, including ash, moisture, alkali solubility, pentosan and methyl pentosan content, methyoxy content, ether extract, cellulose, lignin and "copper number"; for the purpose (1) of following the changes which take place in wood cellulose on successive cooking and bleaching treatment with a view to increasing the yields of purified cellulose by varying these conditions and (2) to determine so far as possible the points of similarity or difference of cellulose from wood and

[1] Immediately after re-icing.

[2] Car re-iced seven hours previous.

that from cotton. The data show that wood cellulose most nearly corresponding to cotton, taking munition linters as a standard, is obtained by recooking "easy bleaching" sulphite pulp with soda and bleaching with two per cent. of bleaching powder. The practise of checking wood cellulose according to the specifications for cotton is a questionable procedure.

Supply and preparation of wood for the manufacture of pulp: HUGH P. BAKER.

Parchmentizing paper and the reaction of mordants: J. E. MINOR. The work of Schwalbe and Becker recently published confirms theories of the author as to the reactions which occur on the decomposition of cellulose during beating. The hydrolysis of cellulose forms dextrines which are mucilaginous, soluble in water and easily reduce Fehling solution. These dextrines are readily adsorbed by pure cellulose thus constituting the reactive, insoluble, colloidal hydrocellulose, and in this position they catalyze further cellulose hydrolysis. Complete hydrolysis leaves only soluble dextrines or sugars. For a mucilaginous accumulation as is desired for making parchment paper, the velocity of the initial reaction must be catalyzed, either by the hemi-celluloses of wood incrustation, or by acid treatment of pulp prior to beating. Acid treatment of pulp reduces the time required to beat to mucilage to one half or one tenth the original amount required, and increases the strength of the paper made from it. Pulp mucilage has a greater power of splitting salts and adsorbing metal ions than has cellulose and, therefore, assists in holding size, dye, coating, etc. Metal impregnation weakens paper strength.

Is it feasible to form a section of cellulose chemistry? G. J. ESSELEN, JR.

Solvents for phosgene: CHARLES BASKERVILLE. An impelling factor in causing the Germans to sign the Armistice was a knowledge of the rapid development of the stupendous poison gas program of the United States. One of the earliest gases, a real gas, used by the Germans, was phosgene. It had been manufactured on a small scale in Germany before the war. Small amounts were exported to the United States prior to 1914. It was being produced in this country for similar uses after the blockade had shut off the importation of chemicals in the manufacture of which the Germans had made a specialty. It was transported in small quantities liquefied in cylinders. When hostilities ceased we were producing the poison gas for war purposes at the rate of fifty tons a day, with a program nearly completed for a much larger production. Soon after the Armistice was signed restrictions were imposed which prevented railroad transportation of phosgene liquefied in cylinders. Uses for war gases in peace times have been sought. The author has found several solvents for the gaseous phosgene, among them gasoline, benzine and ethyl acetate, which dissolve an equal weight of the poison gas at ordinary temperatures. The solutions exert practically no pressure beyond atmospheric, so may be transported with safety within ordinary closed containers. On exposure to the air the liquid and dissolved gas evaporate. The solutions offer simple means for the use of a poison gas to exterminate rats and moles. On warming the solutions in suitable vessels the phosgene is liberated and may be used in a pure form in the manufacture of certain coal tar products of color or medicinal value.

An electrometric method for detecting segregation of dissolved impurities in steel: E. G. MAHIN and R. E. BREWER. Previous work has shown that both non-metallic and metallic inclusions cause carbon segregation in steel and the hypothesis has been advanced that this is due to the steel acting to some extent as a solvent for the foreign material. If this is correct the electrode potential of the metal should be altered in the regions immediately surrounding the inclusion. It is not possible to determine this point by the usual method involving immersion of the specimen in an electrolyte but a method has been devised for exposing microscopic areas of metal surface to an electrolyte, so that the micro-electrode thus formed may be connected with a standard calomel half-element and the E.M.F. of the system measured by the usual compensation method. This method has been applied to an investigation of the ferrite bands produced by heating steel in contact with metallic inclusions; it has been found possible thus to measure the potential of these micro-areas and to establish the fact that the ferrite of these segregated portions possesses a distinctly lower potential than the ferrite of the body of the steel. The work is being extended to include investigation of the potential of ferrite adjoining other metallic and non-metallic inclusions and it may be applied also to the detection of segregation of the constituents of non-ferrous alloys.

Soda-lime for industrial purposes: R. E. WILSON. The work to be described in this paper was an

outgrowth of work done in the Chemical Warfare Service to develop soda-lime for military purposes. Soda-lime for industrial purposes, however, must have much greater activity and capacity and, on the other hand, need not be so hard and need not contain an active oxidizing agent, both of which requirements seriously limited the efficiency of the soda-lime used for military purposes. The paper describes extensive experiments designed to determine the best method of manufacturing soda-lime in order to get maximum activity and capacity against the different gases. The factors determining the brand of lime to use and the best percentage of caustic soda and water were found to be the most important variables after the basic method of manufacture was decided upon. Slides will be shown to indicate the effect of each of these variables on the efficiency of the resulting product against CO_2, SO_2, phosgene, chlorine, superpalite and hardness. The final formula developed as the result of these experiments has been used with great success for a variety of commercial purposes and has been found to be many times as efficient as any of the commercial grades now on the market which are made by radically different processes and contain much more alkali.

Flow of viscous liquids through pipes: Robt. E. Wilson and M. Seltzer.

New solvents for rosin extraction: H. K. Benson and A. L. Bennett. The use of Douglas fir as a source of rosin and turpentine is discussed and the method of tapping the forest trees now in use to a limited extent is described. Attention is called to the very large quantities of resinous mill waste which could be made available for rosin production under proper organization. Realizing that rosin extraction has been under a heavy handicap due to the retention of the solvents by the wood to an extent of as high as 25 gallons per cord in some commercial plants, a search for more easily recoverable solvents was undertaken. Among those that lend themselves to rosin extraction are 5 per cent. ammonium hydroxide and 70 per cent. denatured alcohol solutions. Analytical data are presented on the effect of time and size of wood, on the efficiency of extraction, the decomposition of the ammonia extract, the separation of humus from rosin and the recovery of ammonia from the wood by steam distillation. The following conclusions are presented: (1) When resinous wood of pulp size is treated with 8 times its weight of 5 per cent. ammonium hydroxide for 10 hours 94.5 per cent. of the rosin is extracted. (2) The ammonia extract decomposes slowly in the air at ordinary temperatures and at 90°–100° C. is rapidly and completely decomposed yielding ammonia vapor and finely divided rosin and humus in suspension. (3) Humus does not retain more than 1.7 per cent. of petroleum ether upon heating at 100° C. for thirty minutes. (4) Wood chips saturated with ammonia solution give off the ammonia completely when steam distilled. (5) Denatured ethyl alcohol at a dilution of 70 per cent. is as efficient a solvent for rosin as ammonia, benzene, turpentine or petroleum ether.

Comparative study of vibration absorbers: H. C. Howard. A simple instrument for obtaining records of horizontal and vertical vibration in buildings was constructed. Comparative measurements of the vibration absorbing capacities of various materials and devices, such as cork, felt, rubber air-bags, rubber balls and suspensions were made. Certain arrangements of rubber balls were found to be very effective.

Note on catalysis in the manufacture of ether: Hugo Schlatter. Senderens' experiments (*Comptes Rendus*, Volume 151, page 392) on the action of aluminum sulphate in the manufacture of ether were repeated in glass apparatus and confirmed. When the same experiments were carried out in a small ether still constructed of lead, no difference in production was observed between the usual method of procedure and the process in presence of aluminum sulphate. The author's conclusions are against Senderens' theory of the formation of a double salt, inasmuch as not only lead sulphate, which is normally present in the lead stills used in factory practise, but broken porcelain also gives the same results as aluminum sulphate.

Charles L. Parsons,
Secretary

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